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**FINAL**

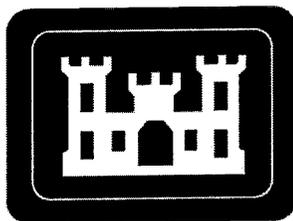
# **PROPOSED PLAN FOR THE MADISON SITE**

**MADISON, ILLINOIS**

**JANUARY 2000**

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**U.S. Army Corps of Engineers  
St. Louis District Office  
Formerly Utilized Sites Remedial Action Program**

## GLOSSARY OF TERMS

Specialized terms used in this Proposed Plan are defined below:

**Alpha decay**– a radioactive process in which an alpha particle is emitted from the nucleus of an atom. An alpha particle is a helium nucleus.

**Applicable or Relevant and Appropriate Requirements (ARARs)** – the Federal and State environmental laws that a selected remedy will meet. These requirements may vary among sites and alternatives.

**Beta decay**– a radioactive process in which a beta particle is emitted from the nucleus. A beta particle is similar to an electron.

**Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)** – means CERCLA as amended by the Superfund Amendments and Reauthorization Act.

**Critical group** – means the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstance (10 CFR 20).

**Ex situ** – the removal of a medium (for example, water or soil) from its original place, as through excavation, in order to perform the remedial action.

**Gamma Radiation** – penetrating radiation emitted from the nucleus of a radioactive atom, gamma rays are similar to x-rays.

**Ground water** – underground water that fills interstitial spaces between soil and rocks to the point of saturation. Ground water is often used as a source of drinking water via municipal or domestic wells.

**Land Disposal Restriction (LDR)** – The land disposal restrictions program requires certain wastes to be treated before they may be disposed of in the land.

**Monitoring** – ongoing collection of information about the environment that helps gauge the effectiveness of a clean-up action, determine potential exposures to workers, and establish potential risks to workers or members of the public.

**millirem (mrem)** – one thousand of a rem. A measure of the biological effect of ionizing radiation. 100 mrem equals/millisievert (mSv).

**Organic compounds** – carbon compounds, such as solvents, oils, and pesticides. Most are not readily dissolved in water. Some organic compounds can cause cancer.

**Present Worth Analysis** – a method of evaluation of expenditures that occur over different time periods. By discounting all costs to a common base year, the costs for different remedial action alternatives can be compared on the basis of a single figure for each alternative. When calculating present worth cost for Superfund sites, total operations & maintenance costs are to be included.

## GLOSSARY OF TERMS (CONT'D)

***Potentially Responsible Party (PRP)*** – individuals or organizations etc., who may be potentially responsible for the presence of contamination at a site.

***Resource Conservation and Recovery Act (RCRA)*** – the federal act that established a regulatory system to track hazardous wastes from the time they are generated to their final disposal. RCRA also provides for safe hazardous waste management practices and imposes standards for transporting, treating, storing, and disposing of hazardous waste.

***RESRAD*** – software program for calculating radiological dose and risk.

***Revegetate*** – to replace topsoil, seed, and mulch on prepared soil to prevent wind and water erosion.

***Safe Drinking Water Act Maximum Contaminant Level (SDWA MCL)*** – the maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

***Total effective dose equivalent (TEDE)*** – means the sum of the deep-dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

***Total Uranium*** – for radioactive decay, total uranium refers to the contribution from all of isotope of uranium including U-238, U-234, and U-235.

## **Proposed Plan for the Madison Site Formerly Utilized Sites Remedial Action Program (FUSRAP)**

### **USACE Announces the Availability of its Proposed Plan for the Madison Site**

The U. S. Army Corps of Engineers (USACE), St. Louis District, is conducting a cleanup program for the Madison Site located in Madison, Illinois. The site was used to perform extrusions of uranium metal and straightening of extruded uranium rods for the U. S. Atomic Energy Commission (AEC) during the late 1950s and early 1960s.

The USACE is authorized under Formerly Utilized Sites Remedial Action Program (FUSRAP) to develop a plan to address the presence of uranium contamination in dust on overhead steel beams at the Madison Site. In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, the USACE issued a Proposed Plan describing the preferred remedy for removing the uranium contaminated dust at the site. The Proposed Plan provides background information on the Madison Site, presents the rationale for selecting the preferred remedy, and outlines the public's role in helping the USACE make a final decision.

Four alternatives are discussed at length in the Feasibility Study (FS) for the Madison Site. The Proposed Plan provides a summary of each alternative and provides a rationale for the selection of this alternative.

The USACE, in consultation with the State of Illinois and USEPA, will select a final remedy for the site after reviewing and considering all comments submitted during the public comment period.

The USACE is issuing this Proposed Plan for at least 30 days of public comment. The USACE encourages the public to review these documents to gain a more comprehensive understanding of the site and FUSRAP activities that have been conducted on the site to date.

Once all comments submitted have been considered, the USACE shall select the final remedial action for the Madison Site. Therefore, the public is encouraged to review and comment on each of the alternatives presented in this Proposed Plan.

#### **DATES TO REMEMBER:**

*MARK YOUR CALENDAR!*

#### **PUBLIC COMMENT PERIODS:**

**January 28, 2000 to February 28, 2000**

USACE will accept written comments on the Proposed Plan during the 30-day public comment period, which begins January 28, 2000.

#### **PUBLIC MEETING:**

**February 17, 2000**

USACE will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at Madison City Hall, 615 Madison Avenue, Madison, Illinois 62060, (618) 451-4838.

#### **For more information, see the Administrative Record at the following locations:**

- USACE, FUSRAP Project Office  
9170 Latty Avenue  
Berkeley, Missouri 63134  
(314) 524-4083
  
- Madison Public Library  
1700 5<sup>th</sup> Street  
Madison, Illinois 62060  
(618) 876-8448

# PROPOSED PLAN FOR THE MADISON SITE

## INTRODUCTION

This Proposed Plan describes the U.S. Army Corps of Engineers' (USACE's) preferred remedy for addressing contaminants resulting from past uranium fabrication operations at the Madison Site located at College and Weaver Streets in Madison, Illinois (see Figure 1). The Madison Site was used to perform extrusions of uranium metal and straightening of extruded uranium rods for the U.S. Atomic Energy Commission (AEC) during the late 1950s and early 1960s. Public Law 106-60 grants authority to USACE to conduct response actions at this site under the Formerly Utilized Sites Remedial Action Program (FUSRAP) subject to requirements of the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA). The Plan is being submitted for public review and comment prior to the final selection of a remedy for the site.

This plan identifies the USACE's recommendation for addressing AEC-related wastes present at the Madison Site. It also provides background information on the Madison Site, describes the alternatives considered to remediate the site, presents the rationale for selection of the preferred remedy, and outlines the public's role in helping the USACE make a final decision on the remedy approach. The USACE will select a final remedy in a Record of Decision (ROD) for the Madison Site, but only after the public comment period has ended and the comments received have been reviewed and considered. USACE may modify the preferred alternative presented here or select another option from this plan based on public comments. Therefore, the public is encouraged to review and comment on all the alternatives identified in this plan. Additional instructions regarding the public

comment period are provided at the end of this document.

## SITE BACKGROUND

### History

During the late 1950s and early 1960s, the Dow Metal Products Division of Dow Chemical Company performed work at the Madison Site (the former Dow Chemical Company facility) for the Atomic Energy Commission (AEC). The work was performed under a subcontract to Mallinckrodt Chemical Company. Work performed at the Madison Site for the AEC was limited to extrusions of uranium metal and straightening of extruded uranium rods. No other operation or period of involvement (for the AEC) with the processing or handling of radioactive material has been discovered. Records suggest that the total quantity of uranium involved in the operation was small. Under the terms of the subcontract Mallinckrodt designed (for approval by Dow) dust arresting and other protective equipment. Mallinckrodt was also responsible for arranging for the Health and Safety Laboratory of the AEC to perform periodic surveys of breathing zone air quality. Mallinckrodt also retained responsibility for the accountability of the uranium metal during the work cycle. After AEC operations were completed, Mallinckrodt removed unused uranium material and cleaned up the facility, although records detailing the operations or the effectiveness of the cleanup have not been located.

Dow Chemical Corporation leased the Madison facility to Phelps Dodge Aluminum Corporation in 1969. Consolidated Aluminum Corporation

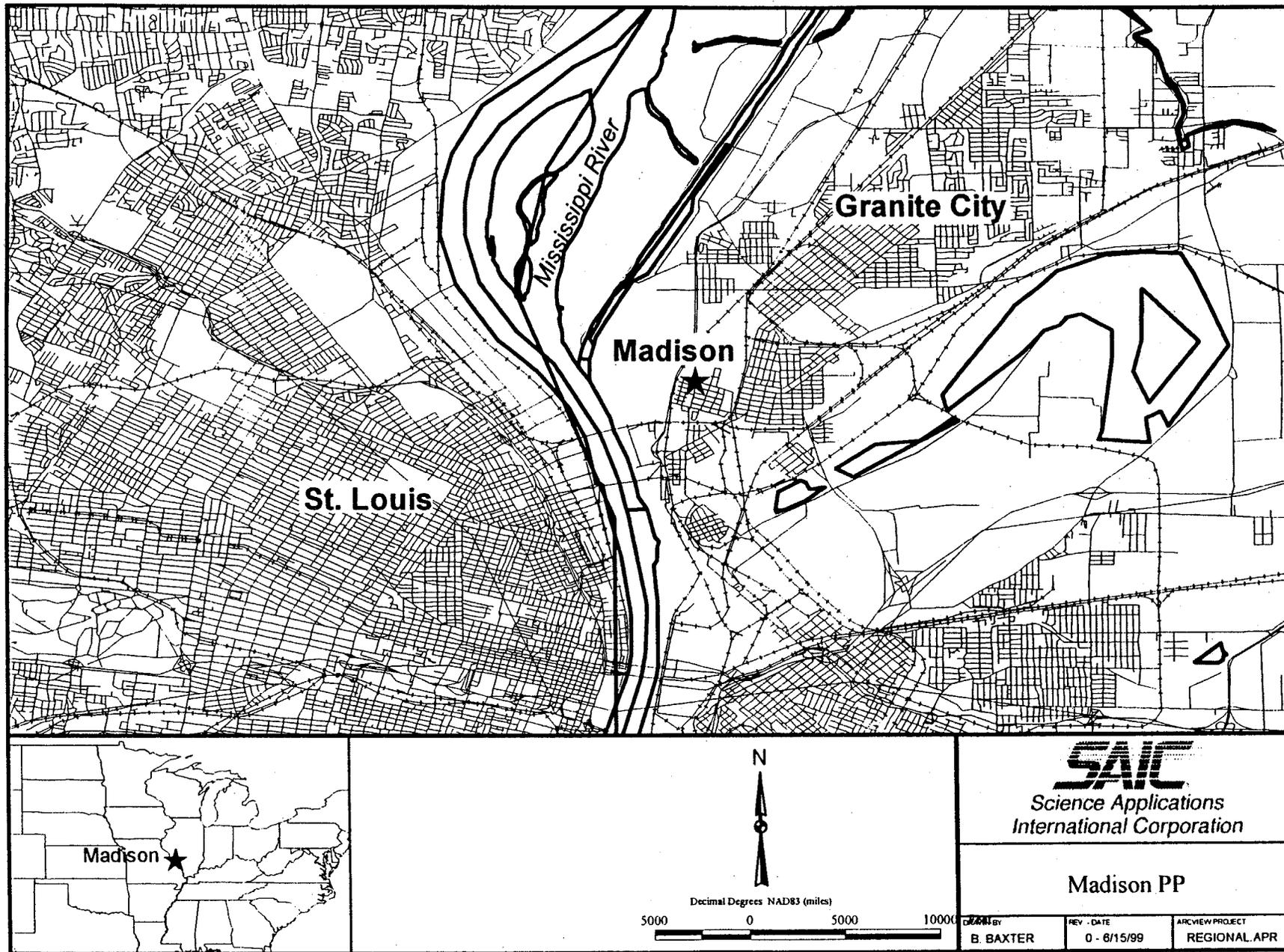


Figure 1. Location of Madison Spectrulite Consortium

assumed the lease in 1973 and exercised an option to buy the plant in 1973. Consolidated Aluminum Corporation applied for and received a license from the Nuclear Regulatory Commission (NRC) in August 1982. Consolidated Aluminum manufactured magnesium thorium alloys at the Madison Site.

Consolidated Aluminum Corporation sold the Madison plant to Barnes Acquisition, Inc. (which appears to have been a subsidiary of Spectrulite) in September 1986. In August 1986, W. A. Barnes requested that Consolidated NRC license "relating to the manufacturing of magnesium thorium alloys and the storage of same be transferred to the surviving company". Apparently NRC denied this request and Spectrulite applied for and was granted an NRC license in October 1986. The Spectrulite license was for the manufacture of magnesium-based thorium alloys and listed the byproduct, source, and/or special nuclear material covered under the license as thorium (solid metal), thorium (Mg-Th hardener), and thorium (magnesium sludge).

The licensed processes being conducted by the current facility owners, Spectrulite, involve thorium-232. This thorium is not related to the AEC contamination. The USACE is only authorized to address uranium contamination resulting from the AEC operations.

### Site Characteristics

The Madison Site consists of a large, multisectional complex of 10 interconnecting buildings with a total, enclosed area of about 130,000 square meters (1.4 million square feet) as shown in Figure 2. Work for the AEC was conducted in Building 6, which is about 83 meters (m) (275 feet) wide and 303 m (1,000 feet) long. The main bay ceiling is approximately 14 m (46 feet) high, 18 m (60 feet) at the highest point along the building

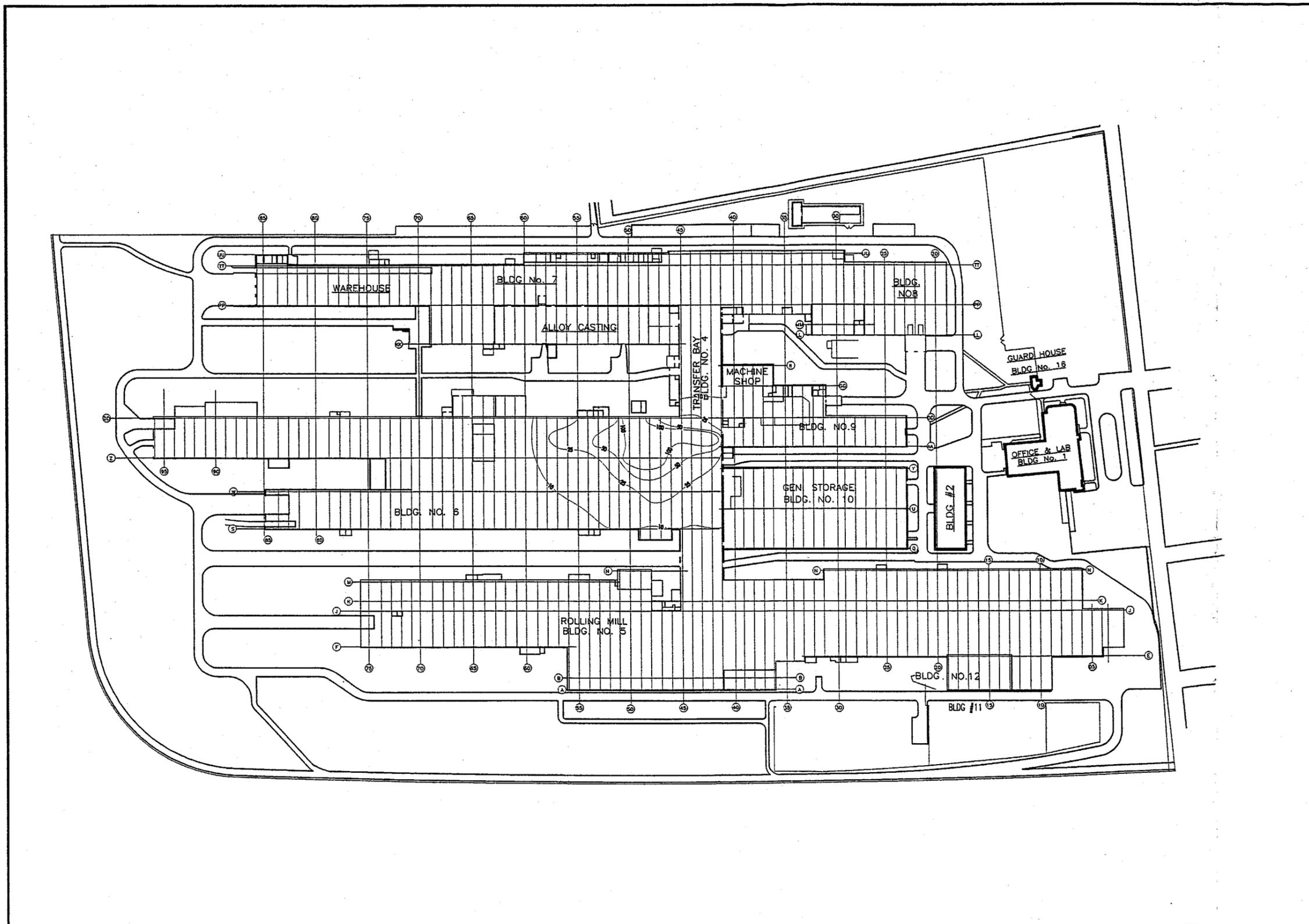
centerline. The structure consists of steel columns, beams, and vertical and horizontal cross members. Walls are concrete block with brick veneer. Floors are rough and pitted concrete. Much of the floor in the vicinity of the extrusion press is covered with a thin layer of oily dirt and fine metal debris. Contamination from the uranium extrusion activities has been detected in dust on overhead beams in the general vicinity of the extrusion press.

### NATURE AND EXTENT OF CONTAMINATION

Two primary characterization efforts have been conducted at the Madison facility. Oak Ridge National Laboratory (ORNL), under contract with DOE, performed a preliminary radiological survey of the facility in March 1989. The second radiological survey was performed by the USACE in the summer and fall of 1998. A summary of the results of these investigations follows. More information is provided in the referenced reports. A more detailed summary is also available in the remedial Investigation and the Feasibility Study for the Madison Site.

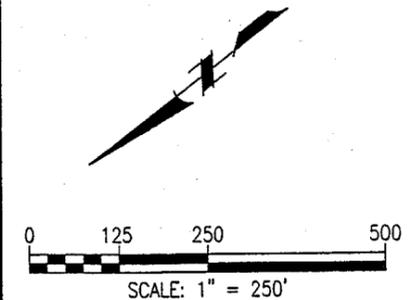
#### 1989 ORNL Survey

The 1989 ORNL survey was conducted to establish the radiological status of the facility. ORNL concluded that most of Building 6 was free of residual radioactive material attributable to former AEC sponsored activities. Above-background levels of uranium were identified in dust on overhead surfaces above the general vicinity of the extrusion press. The maximum concentration measured was 310 pCi/g of uranium-238 (U-238); this is equivalent to a total uranium concentration of approximately 635 pCi/g. The ORNL report recommended further investigations to better define the extent of uranium contamination in Building 6 and the adjacent Building 4. As a result of



**LEGEND:**

- ROAD
- WALLS
- FENCE
- WALKWAY
- BUILDINGS
- COLUMN LINE
- ISOCONTOUR FOR URANIUM  
TOTAL pCi/g IN DUST



**SAIC**  
 Science Applications  
 International Corporation

**Madison Site  
 Remedial Investigation  
 Madison, Illinois**

REVISION	DRAWN BY:	CHKD. BY:	DATE:
0	S. Kitchings	J. Waddell	10/22/99

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Figure 2. Buildings at the Madison Site

these survey findings, the facility was designated into FUSRAP.

### 1998 USACE Survey

The purpose of the 1998 USACE survey and sampling effort was to: 1) characterize the current radiological conditions of the Madison Site attributable to AEC operations; and 2) perform final status survey activities on areas of the facility determined by the ORNL survey to be unaffected by previous AEC operations.

Survey activities included:

- surface beta scans,
- surface gamma scans,
- measurements of total beta surface activity,
- measurements of removable alpha and beta activity,
- measurement of gamma exposure rates at 1 m above the surface,
- sampling surface dust from overhead surfaces,
- sampling residues from the floor and floor penetrations, and
- sampling soil (for the final status survey effort only).

These activities confirmed that AEC-related contamination (U-238) at the Madison site is in the form of dust adhering to the overhead surfaces in the vicinity of the extrusion press. The contamination pattern is similar to that observed in the 1989 ORNL survey; however, total uranium concentrations observed were approximately 40 to 50% lower than those from the ORNL survey. The mobility of the contamination was concluded to be limited, based on the fact that the contamination is still present on the overhead beams. The activities that deposited this contamination were discontinued over 30 years ago. The contamination was also found to be confined within the structure. No airborne uranium was detected during sampling activities, and no contamination was detected on the

equipment and floor surfaces directly beneath the contaminated beams. This provided further evidence that the contamination is not migrating.

The surfaces where uranium was detected are in Buildings 6 and 4. The radionuclide analysis showed the contaminants are a natural uranium isotopic mixture (approximately 50.6% U-234, 2.3% U-235, and 47.1% U-238 by activity). The area that contain uranium are horizontal surfaces above the extrusion press, including beams, cross members, and window ledges. The dust on overhead surfaces ranged from "dry to oily layers", except above the extrusion press where the dust was described as a "hard cake type material." Dust thickness was reported to range from 0.64 to 0.95 centimeter (0.25 to 0.37 inches).

Details regarding the number of measurements taken, the locations, and the individual results can be found in the *Remedial Investigation Report for the Madison Site*.

### SUMMARY OF SITE RISKS

Baseline risk and dose assessments were performed for the radiological conditions that exist at the facility. Radiological conditions specifically include elevated concentrations of uranium on overhead surfaces (e.g., I-beams) in Buildings 6 and 4 above the general area of the extrusion press. The results of these assessments are contained in Appendix B of the *Remedial Investigation Report for the Madison Site*.

Existing state and federal regulations impose obligations on license holders to limit radiation exposures to workers, invitees, and members of the public from any source of radiation other than natural background and medical exposures. OSHA standards also impose worker protection requirements for radiation exposure at this

facility. Actions to comply with these requirements by the facility owner serve as controls that limit radiation exposures to assure protectiveness for site workers in normal operations. If these controls should be lost or fail then doses to facility workers could exceed the 100 mrem per year limit prescribed by the NRC.

The exposure scenarios evaluated assumed that no additional actions are taken to reduce, contain, or remove the contamination in the building, and no additional worker controls are implemented to reduce exposure to the contaminated dusts.

Two types of workers were considered for the dose and risk assessment: a worker on the floor level, and a worker who works in closer proximity to the contaminated overhead surfaces. The worker on the floor level is assumed to be exposed daily for 8 hours, 250 days per year for 25 years. The worker that works in the overhead structures performs work such as pulling cables and changing light bulbs, for an estimated 20 hours per year for 25 years.

Table 1 summarizes the risks and annual total effective dose equivalent (TEDE) for each worker potentially exposed during operations at the Madison Site. The risk assessment concludes that doses due to uranium present in the dust on overhead structures, in the vicinity of the extrusion press, do not exceed exposure criteria for workers on the floor level. However, potentially unacceptable doses could exist for the utility worker who is in close contact with contaminated surfaces in the overhead structures.

Doses to potential receptors following the end of operations at the facility were also considered. Doses to a construction worker demolishing the building were estimated to be less than 1 mrem, assuming normal construction practices for dust suppression.

Additionally, scenarios involving recycle of the steel from the contaminated overheads results in less than 1 mrem exposure.

### **REMEDIAL ACTION OBJECTIVES AND APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS**

The objective of any remedial action for the Madison Site is to eliminate, reduce or control the unacceptable exposures from uranium on structural surfaces within Buildings 6 and 4. Unacceptable exposure to uranium could exist for utility workers at the facility unless controls are implemented by the owner. As stated previously, USACE is conducting response actions at this site under the FUSRAP and is subject to the requirements of CERCLA. Under CERCLA Section 121(c), a remedial action "shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment."

Two criteria, overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements (ARARs), are specified as the two threshold criteria for evaluating remedial action alternatives in the National Contingency Plan (NCP), at 40 CFR 300.430(e)(9)(iii)(A) and (B).

The chemical-specific ARAR for the Madison site is discussed below. ARARs are used to establish the remedial goal for this response to uranium exposure. Federal and state environmental laws or regulations that establish standards, requirements, criteria, or limitations for this uranium, either as applicable or as relevant and appropriate to the circumstances at the

**Table 1. Summary of Excess Lifetime Cancer Risk and Total Effective Dose Equivalent**

Evaluation Factor	Comparison Criteria	Scenario	
		Site Worker	Utility Worker*
Excess Lifetime Cancer Risk	CERCLA risk range ( $10^{-4}$ to $10^{-6}$ )	$2 \times 10^{-5}$	$5 \times 10^{-4}$ ( $9.5 \times 10^{-5} - 2.0 \times 10^{-3}$ )
TEDE	25 mrem/yr	9 mrem/yr	210 mrem/yr (39 – 790 mrem/yr)

\* The risk and TEDE to the utility worker working close to the contamination in the overhead structures are driven primarily by the assumed dust resuspension factor. A range of values was modeled. The average value is reported first, followed by the range of potential values depending on the dust resuspension factor chosen in the risk model.

Madison site, are considered as possible ARARs.

## **10 CFR 20, Subpart E**

The U.S. Nuclear Regulatory Commission's (NRC) rule on radiological criteria for license termination establishes dose criteria that apply when a licensee terminates its license. Although this rule is not applicable since the uranium processing at the Madison Site was not performed under an NRC license, it is relevant and appropriate since the activities conducted at the site and the resulting contamination are similar to those requiring an NRC license. Since, the operations performed at the Madison Site occurred prior to agreement state status for Illinois, licensing, if applicable, would have been by the AEC/NRC.

NRC set policy for Agreement State programs in the "Statement of Principles and Policy for the Agreement State Program Policy Statement on Adequacy and Compatibility of Agreement State Programs." That policy and the implementing Directive 5.9 set identical release limits as a program element that must be implemented as one of the legally binding requirements for an Agreement State to maintain a program that is compatible with NRC's regulatory program. Directive 5.9 states that "concentration and release standards" are a Category A program element, for which it is mandatory that the states adopt identical standards. Illinois regulations, defining decommissioning criteria, that implement the agreement state requirements must be identical to the standards of 10 CFR 20 Subpart E. In accordance with NRC Management Directive 5.9, the state and federal dose standards for this cleanup would be identical to that defined in 10 CFR 20 Subpart E.

The pertinent section of this ARAR are shown below:

### **§ 20.1402 Radiological criteria for Unrestricted Use**

A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from ground water sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels that are ALARA must consider any detriments such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.

## § 20.1403 Criteria for License Termination Under Restricted Conditions

A site will be considered acceptable for license termination under restricted conditions if:

- a) The licensee can demonstrate that further reductions in residual radioactivity necessary to comply with the provisions of § 20.1402 would result in net public or environmental harm or were not being made because the residual levels associated with restricted conditions are ALARA must take into account consideration of any detriments, such as traffic accidents, expected to potentially result from decontamination and waste disposal;
- b) The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem (0.25 mSv) per year;
- c) The licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site. Acceptable financial assurance mechanisms are-
  1. Funds placed into account segregated from the licensee's assets and outside the licensee's administrative control as described in § 30.35(f)(1) of this chapter;
  2. Surety method, insurance, or other guarantee method as described in § 30.35(f)(2) of this chapter;
  3. A statement of intent in the case of Federal, State, or local Government licensees, as described in § 30.35(f)(4) of this chapter; or
  4. When a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity.
- e) Residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable and would not exceed either-
  - 1 100 mrem (1 mSv) per year; or
  - 2 500 mrem (5 mSv) per year provided the licensee-
    - i. demonstrates that further reductions in residual radioactivity necessary to comply with the 100 mrem/y (1 mSv) value of paragraph (e)(1) of this section are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm;
    - ii. make provisions for durable institutional controls;
    - iii. provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every 5 years to assure that the institutional controls remain in place as necessary to meet the criteria of § 20.1403(b) and to assume and carry out responsibilities for any necessary control and maintenance of those controls. Acceptable financial assurance mechanisms are those in paragraph (c) of this section.

This regulation provides a dose limitation from all possible pathways of exposure and is applied by developing a DCGL, to limit doses to meet the criteria.

## REMEDIAL ACTION OBJECTIVES

The objective of remedial action at the Madison Site is to eliminate, reduce, or control the unacceptable exposures from uranium in dust in Buildings 6 and 4 and to comply with the dose limitation of the ARAR. The DCGL equates to 6,000 dpm/100 cm<sup>2</sup> for surficial contamination and 20 pCi/g for volumetric contamination based on the exposure scenario described in the Feasibility Study.

## SUMMARY OF FEASIBILITY STUDY ALTERNATIVES

The *Feasibility Study for the Madison Site* was prepared to develop and evaluate remedial options for the site based on the results of the Remedial Investigation. Four remedial alternatives were developed in the FS and evaluated using the nine criteria outlined in the National Contingency Plan (NCP). Per USEPA's feasibility study guidance, the cost estimates assume a 30-year performance period for ongoing actions such as monitoring and maintenance. The four alternatives developed for the site include:

### **Alternative 1: No Action**

The no action alternative is required by CERCLA to provide a baseline for comparison against the other alternatives. No remedial actions would be undertaken to reduce, contain, or remove contamination in the building. The facility is assumed to operate in compliance with the existing NRC, Illinois, and OSHA regulations, which impose limitations on occupational and public exposure. Although these regulations assure compliance with exposure limits, this alternative is not in compliance with the ARAR, particularly with respect to loss of institutional controls as it results in unacceptable exposures to workers working close to the contamination in the overhead structures.

### **Alternative 2: Institutional Controls**

Under this Alternative, institutional controls are used to protect against human exposure to contaminated material by preventing or minimizing opportunities for exposure. The facility is assumed to operate in compliance with the existing, NRC, Illinois, and OSHA regulations, which impose limitations on occupational and public exposure. This alternative would include:

- Continued use as an industrial facility,
- Work instructions that identify the contamination and measures to preclude or reduce exposure when employees or contractors are required to perform activities in the vicinity of the contaminated surfaces,
- Airborne particulate sampling and analysis for the isotopes of concern,
- Use of breathing zone monitors if required based on the results of airborne particulate sampling and analysis,
- Maintenance of signs and fences, and
- Period inspections by the government to enforce any such restrictions.

Periodic monitoring and 5-year reviews as required by CERCLA would be used to control the amount and duration of potential exposures. As part of their compliance with NRC, Illinois, and OSHA standards, the facility owner could preclude or reduce exposures in areas in which contaminated surfaces may be encountered. It also includes compliance with the controls by current and future building owners. Although these regulations assured compliance with exposure limits, this alternative is not in compliance with the ARAR particularly, with respect to loss of institutional controls which would result in unacceptable exposures to utility workers working close to the contamination in the overhead structures.

### **Alternative 3: Containment**

The containment alternative would seek to reduce human exposure to contamination on the horizontal surfaces by preventing the dust from becoming mobilized. This could be accomplished by the application of a sprayed coating that would adhere to the beams and immobilize the dust by trapping it beneath the coating. When use of the building is discontinued in the future, radiological controls would be provided for decontamination prior to demolition of the building or disposal of the rubble following building decontamination. Five-year reviews would be conducted to assure that the containment mechanism remains intact, and to control the amount and duration of potential exposures.

### **Alternative 4: Decontamination of Accessible Surfaces and Release of Building**

Under this alternative, radiological contamination on accessible surfaces [horizontal ledges such as window sills, electrical and water conduits, beams at the 7.6 and 11 m (25 and 36 ft) levels, and beams in the high bay that are accessible from windows on the roof] would be removed using appropriate decontamination technologies to a level sufficient to meet or exceed the ARAR. Difficult to access areas are defined as those surfaces which can not be accessed from either the high-bay crane or through windows and areas such as around live power lines. No effort would be made to remove contamination from the difficult to access areas due to difficulty to access and low risk posed by contamination remaining in these areas. The technologies that may be employed include vacuuming, scraping, scrubbing, etc. Contamination can be removed using either aggressive (needle guns, scabblers, chipping hammers, etc.) or non-aggressive (absorbent cloth, nuclear grade vacuum cleaners, paint remover, etc.) techniques. The decontamination work would take place when the building could be made available by the current owner. This typically occurs in July during the week-long annual plant shutdown. This would prevent potential employee exposure to dust mobilized by the decontamination activities, and minimize disruption of plant operations.

This alternative will proceed as follows: The accessible overhead structures and ledges in the building would be initially vacuumed to remove contaminated dust. If removable contamination remained above guidelines following vacuuming, then the surface would be scrubbed or scraped to loosen crusted contaminated materials, followed by re-vacuuming to ensure the removal was as low as reasonably achievable (ALARA). Final status surveys would be done to confirm that the ARAR had been achieved.

Following decontamination of the overhead structures, the equipment and floor areas beneath the decontamination activities, and the areas identified in the Remedial Investigation as containing isolated locations slightly above the guideline level, would be surveyed to ensure

these areas meet the ARAR. If found to exceed the ARAR, the floor would be decontaminated using methods similar to the overhead areas.

Waste generated by the decontamination activities would be disposed in an appropriately licensed or permitted disposal facility. Waste packaging would be performed in accordance with all applicable federal, state and local laws and regulations. Shipping containers would meet Department of Transportation requirements. Paint removed from the building surfaces would be sampled for Resource Conservation and Recovery Act (40 CFR 261) hazardous waste characteristics and would be stored, handled, and disposed in accordance with all applicable regulations. Post remedial surveys would be conducted to assure compliance with the ARAR.

No five-year reviews are required because the potential for unacceptable exposures would be eliminated by the removal action.

## EVALUATION OF ALTERNATIVES

The four alternatives were evaluated using the nine CERCLA criteria to determine the most favorable actions for remediation of the Madison Site. These criteria are described below.

### CERCLA Evaluation Criteria

#### *Threshold Criteria (must be met)*

- ***Overall Protection of Human Health and the Environment*** – addresses how the alternative, as a whole, achieves and maintains protection of human health and the environment.
- ***Compliance with Applicable or Relevant and Appropriate Requirements*** – addresses if a remedy would meet all of the site ARARs..

#### *Primary Balancing Criteria (identifies major trade-offs among alternatives)*

- ***Long-Term Effectiveness and Permanence*** – addresses the remaining risk and the ability of an alternative to protect human health and the environment over time, once remedial action objectives have been met.
- ***Short-Term Effectiveness and Environmental Impacts*** – addresses the impacts to the community and site workers during cleanup including the amount of time it takes to complete the action.
- ***Reduction in Toxicity, Mobility, or Volume through Treatment*** – addresses the anticipated performance of treatment that permanently and significantly reduces toxicity, mobility, or volume of waste.
- ***Implementability*** – addresses the technical and administrative feasibility of an alternative, including the availability of materials and services required for cleanup.
- ***Cost*** – compares the differences in cost, including capital, operation, and maintenance costs.

*Modifying Criteria (formally evaluated after the comment period)*

- **State Acceptance** – evaluates whether the State agrees with, opposes, or has no comment on the preferred alternative. This criterion is evaluated formally when comments on the Proposed Plan are reviewed.
- **Community Acceptance** – addresses the issues and concerns the public may have regarding each of the alternatives. This criterion is evaluated formally when comments on the Proposed Plan are reviewed.

## **ALTERNATIVE COMPARISON**

The advantages and disadvantages of each of the alternatives were compared using the nine evaluation criteria established in Section 300.430(d)(9)(iii) of the NCP. These comparisons are summarized below. The detailed comparison of the alternatives can be found in the *Feasibility Study for the Madison Site*.

### **Threshold Criteria**

Except for Alternative 1 (No Action), all of the alternatives are protective of human health and the environment. Alternative 1 is not considered protective. Long-term risk reductions obtained by Alternative 4 (Decontamination) and Alternative 3 (Containment) are offset by increased short-term risks to the remediation worker conducting the decontamination or containment activities because it would effectively control potential exposure without incurring additional short-term risks to the remedial action worker, Alternative 2 (Institutional Controls) ranks high in overall protection of human health and the environment as long as the institutional controls remain effective. It does not, however, comply with the ARAR that defines requirements if institutional controls are lost.

Only Alternative 4 (Decontamination) complies with the ARAR for unrestricted release of a facility. Contamination at levels above the cleanup levels specified by the ARAR for unrestricted release of a facility would remain in place under Alternatives 1 through 3. Alternative 2 (Institutional Controls), and Alternative 3 (Containment), would not result in the release of the facility for unrestricted use; both alternatives would require use restrictions to ensure protectiveness. The transportation and off-site disposal of the removed materials in Alternative 4 (Decontamination) causes a slight increase in risks due to transportation and disposal.

### **Primary Balancing Criteria**

Alternatives 1 (No Action) and 2 (Institutional Controls), do not involve intrusive remedial activities which would result in community or worker exposure to the contamination. Alternatives 3 (Containment) and 4 (Decontamination) involve little to no risk to the community, but remedial action workers would be subject to increased risks during the performance of the work.

The long-term effectiveness of the alternatives varies. Alternative 1 (No Action) would not be effective in the long-term because contamination would remain in place. Alternatives 2

(Institutional Controls) and 3 (Contamination) require continued institutional controls to restrict future exposures to the contamination. These controls would include the use of five-year reviews. Alternative 4 (Decontamination) is most effective over the long-term, because contamination would be removed and the facility could be released from the associated restrictions.

None of the alternatives use treatment to reduce the toxicity, mobility, or volume of contaminants at the site. No effective treatment to reduce toxicity, mobility, or volume was identified. The radioactivity can not be destroyed or reduced by any chemical or physical process. The materials used in Alternative 3 (Contaminant) will increase the volume in exchange for a potential reduction in mobility. Extraction of the uranium is not practical for the small volume of waste that will be generated.

All of the alternatives are technically feasible to implement. Alternatives 3 (Contaminant) and 4 (Decontamination) would be the most difficult to implement. This is because containment and decontamination activities would require work in the high bay areas of the building (in close proximity to the contamination); these areas present access limitations due to the facility construction. Additionally, Alternatives 3 (Contaminant) and 4 (Decontamination) would require coordination with existing facility work activities to limit potential exposures to the employees during remedial action activities.

The cost of each of the alternatives is provided in Table 2. No action incurs no additional costs, but also provides no additional protection and fails to meet the threshold criteria as required by CERCLA.

**Table 2. Cost Comparison**

<b>Alternative</b>	<b>Cost*</b>
Alternative 1: No Action	0
Alternative 2: Institutional Controls	\$60,000
Alternative 3: Containment	\$450,000
Alternative 4: Decontamination	\$250,000

\*30 year cost in 1999\$ and zero discounting

Alternative 4 (Decontamination) is the most cost-effective of the action alternatives at \$250,000.

### Modifying Criteria

State and community acceptance will be evaluated following review of comments on the FS/PP received during the public comment period.

### MADISON SITE PREFERRED ALTERNATIVE

The USACE recommends Alternative 4, Decontamination. The decontamination of accessible surfaces would include the structures inside Buildings 6 and 4 at the Madison Site which are generally at the 25 and 36 foot levels, and the windows and wall areas that were contaminated near the previous AEC operations. The areas will be vacuumed, scraped and brushed, and wiped down with cloths as required. Covers such as plastic will be used to prevent the spread of contamination to the floor below or to other areas of the facility. The scope of the preferred alternative includes:

- Preparation of detailed work instructions and a health and safety plan that address the procedures for handling radioactive materials, procedures for other biological or chemical hazards that could be encountered, and general industrial safety concerns such as lock out and tag out of energy sources.
- Site mobilization and preparation of designated areas for managing wastes generated during the decontamination activities.
- Decontamination of the uranium contaminated surfaces using vacuuming, scraping and brushing, and wiping to meet the DCGL of 6,000 dpm/100 cm<sup>2</sup> for surficial contamination or 20 pCi/g of total uranium volumetric

contamination and the dose limits of the ARAR.

- Use of vacuums with HEPA filters. Hand held power tools will be local exhaust equipped with HEPA filtered exhaust for surface decontamination.
- Use of controls and monitoring during the remedial action to ensure protection and to ensure that no member of the public receives radiation doses above the standards in the ARAR.
- Sampling and analysis of wastes to demonstrate compliance with waste acceptance criteria.
- Packaging, loading and shipment of materials for shipment to licensed or permitted disposal facilities.
- Painting and restoration as required.
- Post remedial surveys and analyses using techniques consistent with MARSSIM. These surveys will be performed to document compliance with the unrestricted release criteria in the ARAR. The sampling will include the areas where decontamination activities are performed, the production areas on the floor level, and some sampling of the difficult to access areas.

The effectiveness of the remediation will be confirmed using survey instruments and sampling. Areas above the general 36-ft level that are not readily accessible from the windows will not be decontaminated. Painting will be done to restore surfaces after the scraping and brushing, as applicable. Radioactive materials generated during the remedial activities will be disposed at appropriate existing licensed or permitted disposal facilities. Post-decontamination surveys will be conducted to ensure compliance with the ARAR. This action would complete the remediation of the Madison Site.

This alternative is protective of human health and the environment, attains the ARAR, is cost effective, and balances other

considerations for the site. The proposed alternative will meet the ARAR by removing contamination from areas where repeated exposure to the radioactive material could occur during maintenance operations. The remedy balances the risk to remediation workers by focusing on areas most likely to result in exposure to employees, and limiting remediation activities in the higher, more difficult to access areas where falls or injuries could be a problem for the remediation worker. These more difficult to access areas are not subject to periodic maintenance activities, therefore potential exposures are limited.

For the accessible areas of the overheads at the 25- and 36-ft levels, the remediation will ensure compliance with the ARAR. The material left in the difficult to access areas will not result in exposures greater than the limits in the 10 CFR 20 Subpart E ARAR. This approach focuses on the areas where exposure is most likely, and is ALARA, as required by the ARAR.

Radioactive materials will be packaged and transported according to the acceptance criteria of the disposal facility as well as applicable Department of Transportation requirements. Materials will be shipped from the facility by truck or rail. The disposal location(s) will be selected after bids are evaluated. Operations will be conducted in compliance with all applicable laws, orders, and regulations.

The preferred alternative would be the final remedy for the site. No five year reviews would be conducted because the potential for unacceptable exposures would be eliminated. Treatment is not included because no effective treatment processes were identified.

## **COMMUNITY ROLE IN THE SELECTION PROCESS**

Public input is encouraged by the USACE to ensure that the remedy selected for the Madison Site meets the needs of the local community in addition to being an effective solution to the problem. The documentation used to support the choice of the preferred alternative is available at or through:

USACE FUSRAP Project Office  
9170 Latty Avenue  
Berkeley, Missouri 63134

The preferred alternative may change in response to state consultation or public comment or based on new information received after the PP is issued. Therefore, the public is encouraged to review and comment on all alternatives described in this Proposed Plan and in the supporting Feasibility Study. Comments on the proposed remedial action at the Madison Site will be accepted for 30 days following issuance of the Proposed Plan. A public meeting will be held during the comment period to receive any verbal comments the public wishes to make. Written comments the public wishes to make or submit regarding the preferred alternative or any other aspect of the Feasibility Study and Proposed Plan will be received at the meeting or during the 30-day comment period.

The USACE will respond to the significant comments submitted during the comment period in a Responsiveness Summary. After considering these comments, the USACE will make a final decision on the cleanup remedy for the site, which will be outlined in a document called the Record of Decision (ROD). The Responsiveness Summary will be an attachment to the ROD.

All written comments should be addressed to:

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U.S. Army Corps of Engineers  
St. Louis District  
9170 Latty Avenue  
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